REMARKS

Pursuant to this Preliminary Amendment, Claims 1, 3-8, and 10-17 have been amended, and newly submitted Claims 18-24 have been added. This Preliminary Amendment does not add new subject matter. Moreover, Applicants note for the record that the Preliminary Amendment is submitted to place the above-identified application in proper U.S. format and not to avoid prior art. Therefore, Applicants do not intend to disclaim any subject matter in view of the Preliminary Amendment. Attached hereto is a Substitute Specification including a marked-up version of the changes made thereto by the present Amendment.

Respectfully submitted,

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Dated: May 1, 2006

Marked-Up Version of Substitute Specification

TITLE

A CONTAINER FOR PRODUCT WITH LESS PACKAGING MATERIAL

BACKGROUND

[0001] The present invention relates to the field of the packaging of flowable products such as liquids or pasty products , particularly that of containers intended to contain beverages and more especially mineral water.

[0002] One topic in the packaging area, especially for water is to reduce the weight of the plastic material used, and more particularly to reduce the weight of the bottom of the container. By reducing the weight of the bottom, the first danger is that said bottom is less resistant because of the fact that the bottom is really the part of the container, which is the more submitted to constraints, due to the contact of said bottom with the place where it is disposed. There are already some solutions to that problem, like the container with petaloid bottom: the FR Patent No. 2772720 concerns such a container, wherein the bottom is thinner. Although this patent brings a solution for the bottom, it remains a container with a too high amount of plastic material for the volume of the product filled in said container.

[0003] The objective of the present invention is to have a container for a flowable product with a bottom allowing said container to stand and which for the same volume requires less plastic than a standard container while at the same time having comparable or higher mechanical properties.

SUMMARY

[0004] The subject of the present invention is a container comprising a body formed by walls and a bottom having in his greater section a dimension d_1 and a neck with an internal diameter d_2, said container being made from a semi-crystalline PET, the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the bottom is comprised between 3 and 4 and wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 80 and 120. The volume is given in ml.

[0005] Under bottom in the present description, we understand all the part of the body comprising the space of said body outside the feet, said feet being taken from their most external position. Under body, we understand the container without the neck. Concerning the ratio weight of the walls on weight of the bottom, for bottles on the market, like a 150 cl bottle, the ratio is 31.5g:10.5g (3), for a 50 cl bottle, the ratio is 12.2:3.3 (3.5) and finally for a 1 l bottle, the ratio is 25.70:6.80 (3.78).

[0006] Semi-crystalline PET means in the present specification a PET having a crystallinity comprised between 10 and 60%. More preferably, the crystallinity is comprised between 20 and 40%.

[0007] One specificity of the invention is that the container has feet at the bottom, which are integral with said body. The presence of three feet is a good solution, but for greater volume a presence of 4 or 5 feet is preferred. The geometry of said feet is not critical. Preferably, these feet have a spherical geometry. Concerning the bottom of the container, it has preferably a non flat form. The bottom has a convex form, like a semi-spherical form.

[0008] It is possible for the container of the invention, either to have a neck with a small height, like a couple of millimeters, or to have a neck with a greater height. In this case, the ratio height of the neck on the height of the body is comprised between 1:1 and 1:4. This allows for the consumer a better gripping of said container.

[0009] Preferably, the walls of the body have a thickness of less than 100 μm. The neck of the container has preferably a wall thickness comprised between 150 and 250 μm. Each foot of the bottom of the body has a thickness comprised between 50 and 150 μm.

[0010] In the container of the invention, the part of the bottom between the feet has a greater thickness of that of the walls, for example around 100-200 μm.

[0011] The present invention concerns further a packaging assembly comprising

[0012] a container comprising a body formed by walls having in his greater section a dimension d_1 and a neck with an internal diameter d_2, said container being made from a semi-crystalline PET, the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the bottom is comprised between 3 and 4 and wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 80 and 120,

[0013] a product in the container and

[0014] closing means for closing off or distributing the product from the neck,

[0015] the filled container being substantially incompressible by hand when filled with the product.

[0016] This incompressibility applies for all types of products, even for a still product. In the present specification, incompressible means that when squeezed the filled container only deforms very slightly and then will recover its original shape. In contrast, a standard bottle will buckle and deform. It is also possible according to the invention to have a gasing of the head space, for example at a relative pressure comprised between 0.2 and 1.5 bar. Preferably, the head space is gassed at a relative pressure comprised between 0.4 and 0.7 bar. The gas used is nitrogen or carbon dioxide.

[0017] According to a feature of the invention, the container comprises on its outside a printing made by pad printing. The advantage of this solution, is that it suppresses the need of having a paper stuck around the container.

[0018] The volume of the container used according to the invention can have all type of capacity, comprised between 5 cl and 20 l capacity. The container is intended to contain all type of product, like pasty, liquid, semi-liquid, granular or powdered product. Under liquid product, we understand water or a still liquid beverage, particularly still mineral waters, carbonated water or a carbonated liquid beverage, particularly sparkling mineral water. Other types of liquid products are also possible, like chemical products, oil, essence, perfumes, pharmaceutical products. Under pasty products, we understand food and non food products, like mayonnaise, cosmetic compounds and others.

[0019] The means of closing are either a cap, or sealed membrane. The caps can be used for any diameter of opening of the neck. On the contrary, the sealed membranes are preferred with smaller diameter of the neck, for example in the area of 10 mm. In this case, the container can support high compressions, for example by the storage and by the transportation. For diameters of around 10 mm, the container can support an internal pressure of the order of 5 bar. It is also possible to close the container by sealing or welding the neck, wherein a cutting object or similar is provided for the opening.

[0020] As a preference, the container has an ovoid or substantially ovoid overall shape. This natural shape derived from an egg represents a structure whose resistance to vertical and/or transversal loads is optimized, thus making it possible, for a given volume and a given amount of material, to achieve mechanical properties which are equivalent to or even better than the cylindrical or roughly cylindrical shapes customarily encountered in this domain.

[0021] In another embodiment , the container according to the invention has a three dimensional shape convenient for gripping, a spherical, substantially spherical or cylindrical overall shape.

[0022] This is because the geometry with symmetry of revolution is particularly easy and therefore economical to manufacture and has the advantage of allowing the container to be filled with products which can emit gaseous substances, such as carbonated beverages (sparkling waters, sodas, etc.) in particular, which are widely consumed worldwide these days. Such a shape is therefore particularly well suited to these liquids in that the release of carbon dioxide or other gas has a tendency to deform the bodies of bottles which do not have symmetry of revolution, having a negative impact on their stability, grasp and ease of handling, appearance, etc.

[0023] In a preferred feature of the invention, the ratio d2 on d1 of the container is comprised between 1:3 and 1:10. According to a preferred embodiment of the packaging assembly, the ratio weight of the walls on weight of the bottom is comprised between 3.4 and 3.8. According to a further preferred feature of the invention, the ratio volume of the body of the container per gram of PET of the body is comprised between 90 and 110.

[0024] According to another feature, the plastic used to form the wall or walls is a semicrystalline plastic with a slow rate of crystallization, the glass transition temperature (T_g) of which is 70°C or higher and the cristallisation temperature Tc is around 140°C.

[0025] A slow rate of crystallization is to be understood as meaning a rate which makes it possible to have an amorphous state by quick cooling.

[0026] Advantageously, the plastic used to form the wall or walls is chosen from the group formed by PET (polyethylene terephthalate) and PEN (polyethylene naphthalate). It has been noted that the drawing of the PET has no negative influence on the water barrier properties

of the obtained container and that also a thickness of around 50 μm and less guarantees a good safety of the container itself and of the storage.

[0027] In order to guarantee both the flexibility needed for the aforementioned deformation and sufficient mechanical strength, the container according to the invention is further characterized in that the thickness of the wall or walls forming the body of the container is between 30 μm and 100 μm, preferably between 50 μm and 70 μm.

[0028] As already mentioned, small thicker areas or portions of walls may also be provided on the body of the said container, particularly in close proximity to the neck and/or the bottom, so as to reinforce these parts locally. Such reinforcements may in particular be useful to facilitate the filling of the said containers or to increase their stability during storage.

[0029] As a preference, the container is further characterized in that the body and the neck of the container are made as a single piece. This makes it possible to avoid any join or weld which may constitute a region of greater weakness.

[0030] Indeed, according to another feature, the container according to the invention is characterized in that, it has a high resistance to vertical and/or transverse loads allowing good resistance to transportation. For example, for a working volume of 5 litres, the amount of PET used to produce the said container is about 30 g. for resistance to a vertical load of about 65 kg. This represents a significant saving in plastic, the few 5-litre containers that are currently on the market requiring an amount of polymer which, for comparable mechanical strength, is over two times greater than the amount needed to manufacture a container according to the present invention. When containers of lower volumes are used, for example of the order of 33 cl, the quantity of plastic material is of the order of 3-4 g, in comparison with a bottle of the same volume, wherein the amount of plastic is of the order of at least 12 g. This type of container supports a vertical loading of more than about 100 kg. That the container supports a vertical or transverse loading means that the weight given does not deteriorate the package integrity, that is does not lead to a risk of breaking said container.

[0031] These simple shapes also allow the container according to the invention to be used as a refill or recharge for water coolers, for which a flat bottom is not necessary, these refills generally being used by inserting the container, head (neck) downmost, into the accomodation device of the said water cooler. In addition, this type of surface geometry also

makes it possible to increase the area of heat exchange between the said container and the chilling device usually present in the said water coolers.

[0032] According to another alternative form, the container according to the invention is characterized in that the neck is fitted with a closure and/or distribution means produced in the form of a distribution tap which can be operated with one hand.

[0033] Such distribution taps, which are known per se, advantageously allow the distribution of the flowable product contained in the container to be regulated in a particularly convenient way, for example when this container is stored horizontally on the shelves of a refrigerator, the other hand holding the container into which the said flowable product is to be transferred, for example with a view to consuming it.

[0034] Because of its flexible nature, the geometry of the container can also adapt more readily to that of the storage place, as opposed to the rigid cans currently available which need to observe very specified dimensions in order to be able to be stored in restricted spaces such as the internal compartments of refrigerators. In addition, the space freed as a container according to the invention is emptied can also be put to use for storing objects the size or shape of which can vary, which is not the case with rigid containers in which the volume of liquid removed is systematically replaced with air. In this type of container, the volume initially occupied remains so until the empty container is removed from the refrigerator.

[0035] Another subject of the present invention is the use of the container by way of large-capacity, at least 5-litre capacity, container intended to contain water or a still liquid beverage, particularly still mineral water.

[0036] Another subject of the present invention is the use of the container according to the invention by way of large-capacity, at least 5-litre capacity, container intended to contain carbonated water or a carbonated liquid beverage, particularly sparkling mineral water.

[0037] Of course, the containers of the present invention are not in any way limited to flat or sparkling mineral waters but can be intended to contain all sorts of flowable products, edible or inedible liquids of greater or lesser fluidity such as, for example, fruit juices, milk-based beverages, etc., and also sauces or condiments (ketchup, mustard, dressing, etc.) or non-food liquids (deionized water, cleaning products, detergents, etc.).

[0038] The packaging assembly according to the invention can also contain a functional component. The functional component is taken from the group consisting of a fibre, plant extract, fruit extracts, vitamins and flavors. The assembly is pasteurised or sterilised at a temperature in excess of 60°C.

[0039] Finally, another subject of the present invention is a method for manufacturing a body of a container according to the invention, characterized in that the said body is obtained by stretch blow forming of a PET preform with high stretch index in comparison with the classical stretching of a preform. The blow forming can be also a blow molding. Compared with the blowing of plastic bottles, wherein the blowing pressure is comprised between 30 and 40 bar, according to the process of the invention, it is sufficient to blow at a pressure of around 2 times less. This reduces the cost of the process and also of the machine which is used. Concerning the stretch index, it is depending of the volume of the final container. For example, in the case of a container having a volume of less than 100cl, the stretch index is between 100 and 300 cm. In the case of a container having a volume of 500 to 1000 cl, the stretch index is comprised between 500 and 700 cm. In the case of container having volume of 2000 cl or more, the stretch index is around and more than 1000 cm.

[0040] The stretch index is defined as follows :

$$\text{Stretch index} = \frac{\text{internal volume of the stretched container*}}{\text{internal volume of the preform before stretching*}} \times \frac{1}{f}$$

$$f = \frac{\text{internal surface of the container*}}{\text{internal volume of the stretched container*}} \quad (cm^{-1})$$

* with the exclusion of the neck

[0041] In the embodiments of the containers according to the invention, for volumes of 33 cl, 1 liter, 5 l, 10 l and 20 l, the different ratios S2 on S1 are comprised between 1:4.5 and 1:15.

[0042] Because of the substantial incompressibility of the filled container of the invention, there is no need to have reinforcing structures. The consequence is that it is possible to have simple shapes, which have the advantage of providing transparency and purity. This is particularly important for the consumer in the case of a container for drinking water. Another advantage of this container is that it can be emptied without air coming in and this reduces the risk of contamination or odours entering the product that may cause taste changes or degradation.

[0043] The measure of the crystallinity is made on a density column from Lloyd-Davenport, according to following procedure. The column is filled with a salted solution (calcium nitrate) having a density gradient. The column is calibrated with balls having known density between 1.335 and 1.455. Then small pieces of the container of the invention are immerged in the column and after a certain time, they stay at a certain height of the column corresponding to a certain density. The measures are made at 23°C. The following correspondance table with ρ_c of 1.455 gives the cristallinity

Density (g/cm³)	Crystallinity (%) (ρ_c = 1.335)	Crystallinity (%) (ρ_c = 1.455)
ρ_a 1.335	0%	0%
1.345	5.6	8.3
1.355	11.1	16.7
1.365	16.7	25.0
1.375	22.2	33.3
1.385	27.8	41.7
1.395	33.3	50.0
1.405	38.9	58.3
1.415	44.4	66.6
1.425	49.5	75.0
1.435	55.5	83.3
1.445	61.1	91.6
1.455	66.6	100%
1.465	72.2	
1.475	77.2	
1.485	83.3	
1.495	88.8	
1.505	94.4	
1.515	100%	

[0044] Additional features and advantages are described herein, and will be apparent from, the following Detailed Description and the figures.

BRIEF DESCRIPTION OF THE FIGURES

[0045] Other features and advantages of the invention will become apparent from the description which follows, given by way of example and with reference to the appended drawings in which:

[0046] Fig. 1 is a lateral perspective view of the container according to the invention,

[0047] Fig. 2 is another perspective view of the container of the invention, seen from the bottom and

[0048] Fig. 3 is a graph comparing the invention with the state of the art.

DETAILED DESCRIPTION

[0049] In the embodiment described and depicted on figures 1 and 2, the container for a flowable product, particularly for a beverage and, in particular, for mineral water, essentially consists of a body 1, formed by walls 2 and a bottom 3 and a neck 4. The body is made of a semi-crystalline PET. The neck presents a screw 5 for receiving a cap (not shown). The bottom 3 presents three feet 6 integral with the body. The volume of the container is of 1000 ml. In this specific example the ratio weight of the walls on weight of the bottom is of 3.5 and the ratio volume of the body of the container per gram of PET is of 100. This means that for the volume of 1000 ml, there is 10 g of PET for the body (neck excluded). The thickness of the walls is around 70 μm. The neck has a height which is minimised and said neck has a wall thickness of around 200 μm. In the area 7 of the feet, that means around the middle of said feet, the wall thickness is around 150 μm. The feet have a semi-spherical shape. Concerning now the limits of the wall and bottom for calculating the ratio weight of the walls on weight of the bottom, it is outside and inside of the circle 8 of figure 2.

[0050] Concerning now the graph of figure 3, the x axis represents the volume of the container in ml and the y axis represents the ratio volume of the container in ml per g of the plastic material of said container. The graph 1 shows a bottle used on the market for sparkling water. The graph 2 shows a bottle used on the market for still water and the graph 3 shows a container according to the invention. This graph shows very clearly one of the specificity of the invention, which is that less plastic material is needed for conditioning the same volume of product. Taking an example of the graph: according to the invention 1 g of plastic material is needed for 100 ml of product, whereas for products now on the market 1 g of plastic material is needed for only around 40 to 60 ml of product. That means that according to the invention, the need of plastic material is divided by 2.

[0051] It should be understood that various changes and modifications to the presently preferred embodiments described herein will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the

present subject matter and without diminishing its intended advantages. It is therefore intended that such changes and modifications be covered by the appended claims.

ABSTRACT

The invention concerns a container comprising a body 1 formed by walls 2 and a bottom 3 having in his greater section a dimension d_1 and a neck 4 with an internal diameter d_2, said container being made from a semi-crystalline PET, the body of said container comprising at its bottom at least three feet spaced from each other and being integral with said body, wherein for the body, the ratio weight of the walls on weight of the bottom is comprised between 3 and 4 and wherein the ratio volume of the body of the container per gram of PET of the body is comprised between 80 and 120.